भारतीय मानक
Indian Standard

IS 4156 : 2023

बेराइट्स नमूने लेना — पद्धतियाँ

(पहला पुनरीक्षण)

Sampling of Barytes — Methods

(First Revision)

ICS 77.120

© BIS 2023

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

August 2023 Price Group 7

Ores and Feedstock for Iron and Steel Industry Sectional Committee, MTD 13

FOREWORD

This Indian Standard (First Revision) was adopted by Bureau of Indian Standards, after the draft finalized by Ores and Feed Stock for Iron and Steel Industry Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1967. This revision has been brought out to bring the standard in the latest style and format of the Indian Standards. It also incorporates 1 amendment issued to the last version of the standard.

In addition, the following changes have been made:

a) Classification of ores is placed in **3.1**; and
b) Fig. 1 and Fig. 2 were reintroduced for clear indication and reading.

Barytes is an important mineral which is used in large quantities in oil-well drilling and in paints and rubber industries as a pigment. It is a starting raw material for the manufacture of barium chemicals which are now being produced in India. With the opening of more oil-wells in the country, the consumption of barytes is likely to increase steadily. It is also being exported to overseas countries. This standard is intended to fulfil the need for proper methods of sampling which become very important for sound and satisfactory evaluation of quality.

For obtaining reliable conclusions it has been recommended that as far as possible, barytes be sampled when in motion, that is, during loading or unloading. When sampling of stationary ores, for example, from stock piles becomes inevitable, the 'sectional' or the 'trench' sampling method may be used for stock piles up to a maximum height of 1.5 m but the representativeness of the samples drawn in this manner and hence the reliability of the conclusions are not assured.

Barytes is generally offered for sale in the following three forms:

a) Bulk as run-of-mine up to 200 mm size;
b) Bulk as small ore up to 50 mm size (known as pebble ore in the trade); and
c) Crushed and ground form up to 0.05 mm size, generally packed in bags.

The methods for sampling of crushed and ground barytes corresponding to form (c) have been laid down in the respective material specifications required for different industries. This standard, therefore, deals only with sampling of barytes in bulk in the forms (a) and (b).

Taking into consideration the views of producers, testing authorities and consumers, the Committee felt that it should be related to the sampling procedures generally followed in this country for barytes as also for other ores in bulk.

This standard is one of a series of Indian Standards on sampling of ores and aggregates; other standards on methods of sampling in this series are:

IS 1405 : 2010	Iron ores — Sampling and sample preparation — Manual method (*third revision*)
IS 1449 : 2010	Methods of sampling of manganese ores (*second revision*)
IS 1811 : 1984	Methods of sampling foundry sand (*first revision*)
IS 1999 : 1987	Method of sampling bauxite (*first revision*)
IS 2109 : 1982	Methods of sampling dolomite, limestone and other allied materials (*first revision*)
IS 2245 : 1962	Methods of sampling quartzite
IS 2246 : 2023	Methods of sampling fluorspar (fluorite) (*first revision*)
IS 4166 : 1967	Methods for sampling of ilmenite and rutile

This standard is intended chiefly to cover the technical provisions relating to the sampling of barytes, and it does not include all the necessary provisions of a contract.

(*Continued on third cover*)

Indian Standard

SAMPLING OF BARYTES — METHODS

(First Revision)

1 SCOPE

1.1 This standard lays down the procedure to be followed in collecting and preparing samples from a lot in order to determine size distribution, moisture content and chemical composition of barytes in bulk.

1.2 It does not cover barytes in crushed and ground form for which sampling procedures have been laid down in the respective material specifications.

1.3 Sampling of barytes in railway wagons or trucks, ship's holds and stock piles have been considered separately.

1.4 This standard also includes a method for reporting the quality of bulk of the ore sampled.

2 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply:

2.1 Lot — The quantity of barytes offered by the supplier for inspection at one time. A lot may consist of the whole or a part of the quantity ordered for.

2.2 Sub-lot — The quantity of barytes representing each part or portion into which a lot is divided for the purpose of sampling.

2.3 Increment — The quantity of barytes obtained by the sampling device at one time from a lot or sub-plot.

2.4 Gross Sample — The quantity of barytes obtained by mixing together all the increments collected from a sub-lot.

2.5 Composite Sample — The sample obtained by mixing the weighted quantities of gross samples or laboratory samples of different sub-lots to constitute the sample representing an entire lot.

2.6 Size Sample — A sample taken for the determination of the size distribution of the lot or sub-lot.

2.7 Laboratory Sample — The quantity of barytes obtained by reducing the gross sample or composite sample following a specified procedure and intended for laboratory testing for chemical analysis only.

2.8 Moisture Sample — A sample to be used exclusively for the purpose of determining moisture content.

3 GENERAL RULES OF SAMPLING

3.1 Classification

Barytes is generally offered for sale in the following three forms:

a) Bulk as run-of-mine up to 200 mm size;
b) Bulk as small ore up to 50 mm size (known as pebble ore in the trade); and
c) Crushed and ground form up to 0.05 mm size, generally packed in bags.

3.2 The increments shall be collected only with the sampling scoop and should not be picked up by hand.

3.3 The containers and equipment used for collecting, preserving and preparing the samples should be sufficiently clean as to avoid contamination of the samples. If gunny bags are used, these should be clean and of close texture to avoid loss of fines in the samples. Particular care must be taken to avoid contamination with iron since there is often a very rigid limit on this impurity in barytes.

3.4 The samples should be always kept in a place sufficiently protected to avoid changes in its quality, particularly in respect of moisture.

3.5 A gross sample may be used for the combined purpose of determining size, moisture and chemical composition. In such a case, the size determination should be carried out first before preparing the sample for moisture and chemical composition.

3.6 When moisture content is required for the lot and the same gross sample is to be used for preparation of moisture sample and laboratory sample the gross sample should be processed as quickly as possible after collection up to the stage where moisture sample is collection in order to avoid changes in moisture by long storage.

3.7 Moisture samples should always be collected in airtight containers to avoid changes in moisture content and these should be sent to the laboratory for testing without delay.

4 INCREMENTS

4.1 Increments should be taken with the sampling scoop the design of which is shown in Fig. 1.

4.2 The size of sampling scoop to be selected depends on the maximum lump size of the ore as shown in Table 1.

4.3 The increments taken should be of approximately uniform weights.

4.4 Where big lumps exceeding the weight of increment to be taken are encountered at the point selected for samplings the entire lump shall be collected if the sample is to be used for size determination also. Otherwise, the lump may be broken and the required weight of increment collected from pieces.

5 SUB-LOTS

For the purpose of sampling, a lot may be divided into a number of sub-lots of approximately equal weights as specified in Table 2.

NOTES

1 When it is not practicable to have sub-lots of approximately equal weights, sub-lots of varying weights may also be permitted.

2 The object of dividing a lot into a number of sub-lots is only to facilitate the drawing of a representative gross sample rather than to indicate its physical division.

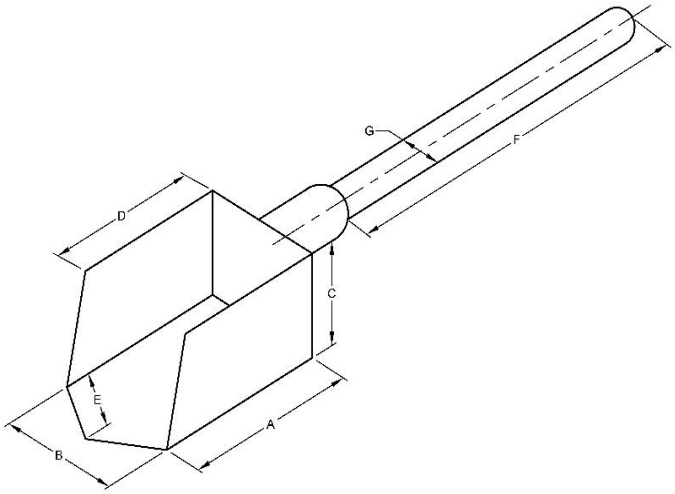

FIG. 1 SAMPLING SCOOP

Table 1 Dimensions of Sampling Scoop

(*Clause* 4.2, 7.3, 8.2, 9.2.3, 9.3.3.3 *and Fig.* 1)

Sl No.	Capacity of Scoop	Maximum Lump Size	Dimensions						
			A	B	C	D	E	F	G
	kg	mm	mm	mm	mm	mm	mm	mm	mm
(1)	(2)	(3)	(4)	(5)	(6)		(8)	(9)	(10)
i)	8	200	200	200	100	175	115	440	40
ii)	2	50	175	100	100	150	65	330	30

NOTE — Dimension A to D should be exact and E to G are optional, given only for guidance.

Table 2 Number of Sub-Lots into which a Lot is to be Divided

(*Clause* 5.1, 7.1, 8.1, 9.2.1, 9.3.2.1 *and* 9.3.3.1)

Sl No.	Weight of the Lot Tonnes	Number of Sub-Lots
(1)	(2)	(3)
i)	Up to 2 000	2
ii)	2 001 to 5 000	3
iii)	5 001 to 10 000	4
iv)	10 001 to 25 000	5
v)	25 001 and above	6

6 NUMBER OF INCREMENTS

The number of increments to be taken from a sub-lot shall be as given below:

Sl No.		*Category of Ore*	
		Run of mine	Small
(1)	(2)	(3)	(4)
i)	Weight of gross sample, kg, *Min*	300	100
ii)	Weight of increment, kg, approx	8	2
iii)	Number of increments, *Min*	38	50

7 SAMPLING FROM WAGONS OR TRUCKS

7.1 For the purpose of sampling, all the wagons or trucks in a lot shall be divided into a suitable number of sub-lots of approximately equal weight as specified in Table 2.

7.2 The samples shall be drawn when the ore is being loaded into or unloaded from wagons or trucks.

7.3 The size of increment and sampling scoop shall be decided as specified in Table 1.

7.4 The minimum number of increments for each sub-lot shall be 38 for run of mine and 50 for small ore.

7.5 A minimum of 25 percent of the wagons or trucks shall be selected at random from the sub-lot. From each of the wagons or trucks so chosen, an approximately equal number of increments shall be collected so as to obtain the specified minimum number of increments from the sub-lot. The increments shall be drawn with the help of a suitable sampling scoop (*see* Fig. 1) at regular intervals at the time of loading or unloading of the wagons or trucks.

7.6 The points in a wagon or truck at which the increments are to be drawn shall be suitably varied so as to cover different locations and depths.

7.7 Combine the increments in a sub-lot to form the gross sample.

7.8 Sampling from loaded wagons or trucks is not generally recommended. If, however, this becomes unavoidable, then the gross sample shall be made up of unit samples as given below:

Sl No.	*Category of Ore*	*Minimum Number of Unit Samples*
(1)	(2)	(3)
i)	Run-of-mine	7
ii)	Small	5

For collecting these unit samples, an equal number of points shall be located at random on the entire ore surface of all the wagons or trucks in a sub-lot. At every selected point a unit sample shall be collected by sectional sampling method (*see* **9.3.2**).

8 SAMPLING FROM SHIPS

8.1 For the purpose of sampling, the quantity of ore loaded into or unloaded from a ship shall be divided into a suitable number of sub-lots of approximately equal weight as specified in Table 2.

NOTE — In case it becomes desirable to sample each batch in hold of the shop separately the quantity of ore in each of the batches which are treated as sub-lots should be ascertained beforehand.

8.2 The size of increment and sampling scoop shall be decided as specified in Table 1.

8.3 The minimum number of increments for each subplot shall be 38 for run of mine and 50 for small ore.

8.4 The increments should be uniformly spread over the total quantity in each sub-lot. Thus, the interval of sampling should be approximately equal and this will be equal to the total quantity in each sub-lot divided by the number of increments to be collected.

8.5 The increments may be collected either from the loading device which may be baskets, skips, grab, bucket, belt, etc, or if possible, it may be collected actually from the hatch of the ship where the ore is discharged by the loading device.

8.6 Combine the increments in a sub-lot to form the gross sample.

9 SAMPLING FROM STACKS OR STOCK PILES

9.1 Samples shall be drawn when the stack or stock pile is cleared for loading into wagons or trucks. However, since sale of barytes is often effected on the basis of stack sampling, procedure has also been laid down for sampling from stationary stacks.

9.2 Sampling during Clearance of Stack or Stock Pile

9.2.1 The total quantity to be sampled should be

divided into suitable number of sub-lots as specified in Table 2.

9.2.2 If the stock pile is in a regular rectangular form with levelled top surface, the sub-lots can be clearly marked out in the stock pile. If this is not possible due to uneven shape of stock pile, the formation of sub-lots may be decided from the total quantity of the material loaded.

9.2.3 The size of increment and sampling scoop to be used is decided from the maximum lump size of ore as specified in Table 1.

9.2.4 The minimum number of increments to be drawn shall be 38 for run of mine and 50 for small ore.

9.2.5 The specified number of increments arc spread over the entire sub-lot uniformly with a random start so that increments are taken at fixed quantity intervals.

9.2.6 The increments taken for each subplot are mixed together to form the gross sample.

9.3 Sampling from Stationary Stacks or Stock Piles

9.3.1 In sampling stationary stacks, the following points should be taken into consideration:

a) Since it is not possible to draw increments uniformly spread over the total quantity in a subplot, samples should be drawn from maximum possible number of points; and
b) Two methods, namely, sectional sampling and trench sampling have been specified. These may be applicable only in cases of stock piles of height less than 1.5 m.

9.3.2 *Sectional Sampling*

9.3.2.1 The lot is divided into the requisite number of sub-lots as specified in Table 2. Each sub-lot should be properly marked out in the stock pile.

9.3.2.2 The gross sample is made up of the number of unit samples specified in **7.8**. For collecting these, the required number of points should be marked out at random over the surface of the ore in the sub-lot.

9.3.2.3 At every selected point, unit sample shall be collected by taking the entire cross-section of the ore from top to bottom over the area of a circle of 200 mm diameter. For doing this, the ore from the surface up to a depth of approximately 250 mm shall be collected first. The bottom of the hole so formed shall be then covered with a plate and the ore lying on the sides of the hole shall be removed up to the level of the plate. The plate is then removed and the hole dug further to collect the sample. The process is repeated till the bottom is reached.

9.3.3 *Trench Sampling*

9.3.3.1 The lot is divided into requisite number of sub-lots as specified in Table 2. Each sub-lot shall be properly marked out.

9.3.3.2 Each sub-lot (sub-stack) shall be trenched in the following manner:

a) The direction and pattern of trenches should be at random without following definite pattern. The pattern should be changed from sub-lot to sub-lot;
b) The trench should extend right up to the bottom of the stack until the ground level is exposed; and
c) In addition to the trenches, the sides of the stack should be opened to expose the ore inside the stack at places where the trench does not expose the ore inside.

9.3.3.3 The size of increment and sampling scoop to be used shall be decided from the maximum lump size as given in Table 1.

9.3.3.4 The minimum number of increments to be drawn shall be 38 for run of mine and 50 for small ore. These increments shall be uniformly spread over the entire sub-lot. They shall also be taken uniformly from the entire cross-section of the exposed sides of trenches from top to bottom.

9.3.3.5 Combine all the increments to form the gross sample.

10 DETERMINATION OF ORE SIZES

10.1 Determination of ore sizes shall be carried out before the gross sample is taken up for sample preparation for moisture and chemical analysis, in case a common sample is drawn for size and quality.

10.2 The sizes of screens to be used shall be decided as required by the parties concerned. The normal sizes required are as follows:

a) Over 200 mm;
b) Over 50 mm and up to 200 mm; and
c) 50 mm and below.

10.3 The total gross sample should first be weighed to ascertain its total weight.

10.4 The gross sample shall be screened progressively from largest size screen to the smallest one.

10.5 The different size groups obtained shall be kept separate and weighed separately.

10.6 Calculations

10.6.1 The percentage of each size in a sub-lot (on weight basis) is calculated as follows:

$$\text{Size percentage} = \frac{\text{weight of each size group}}{\text{total weight of gross sample}} \times 100$$

10.6.2 When the percentage of each size group in the entire lot is required, this shall be calculated as follows:

$$\text{Percentage in each size group} = \frac{a_1 + a_2 + \ldots\ldots\ldots\ldots}{w_1 + w_2 + \ldots\ldots\ldots\ldots} \times 100$$

where

a_1, a_2, …… are the corresponding weights of the respective size group in each of the sub-lots; and

w_1, w_2…….. are the weights of different gross samples of sub-lots.

11 REDUCTION OF GROSS SAMPLE

11.1 Each gross sample shall be reduced separately. If, however, separate analysis of each sub-lot is not required, the gross samples of each sub-lot shall be crushed up to 5 mm size as shown in Fig. 2. After this the gross samples shall be mixed in proportion of the quantities represented by their respective sub-lots to form a composite sample which shall then be reduced as shown in Fig. 2.

11.2 Crushing and grinding shall be done with either mechanical equipment like jaw crusher, cone crusher, roll crusher, disc grinder, etc, or manually with steel plate and hammer or mortar and pestle.

11.3 The equipment required for crushing, reduction, screening, storing and handling, etc, of the samples shall be cleaned sufficiently to avoid any contamination of the sample. Particular care should be taken to remove the remnants of the previous sample processed in the equipment.

11.4 The gross sample after being subjected to the size test, if necessary, shall be crushed to pass completely through 10 mm screen. It shall then be reduced by coning and quartering, riffle divider, sample splitter, rotary divider or increment reduction method to a quantity not less than 50 kg.

11.5 Reduction Methods

11.5.1 *Coning and Quartering*

The crushed ore shall be well mixed and then scooped into a cone-shaped pile. Care shall be taken to drop each scoopful exactly over the apex of the cone to avoid uneven distribution of lumps and fines. The cone thus formed shall be flattened by pressing the top of the cone with a smooth flat surface. The cone is then divided into 4 quarters by 2 lines intersecting at right angles at the centre of the cone. Any 2 diagonally opposite quarters are rejected. The other two quarters form the reduced sample which may be further reduced by the same procedure, if necessary, or taken for further crushing. In rejecting the two opposite quarters, care shall be taken to brush away and reject the fine powder remaining at the bottom on the plate, canvas, etc, used for reduction.

11.5.2 *Riffle Divider*

The crushed material shall be well mixed and then poured uniformly into the riffle divider. The sample collected on one side of the divider shall be taken and that on 'the other side rejected. In order to avoid any errors due to fabrication of the divider, the side which is taken for rejecting the sample, shall be changed alternately. The dividers of different sizes according to the size of crushed ore shall be used.

11.5.2.1 While the design and dimensions of the riffle dividers is not standardized, the following important requirements should be satisfied by the dividers used:

a) The total number of riffles should be even, normally 16; and

b) The width of riffles should he uniform in all the riffles and this should be at least twice the size of the maximum particle size of the crushed material.

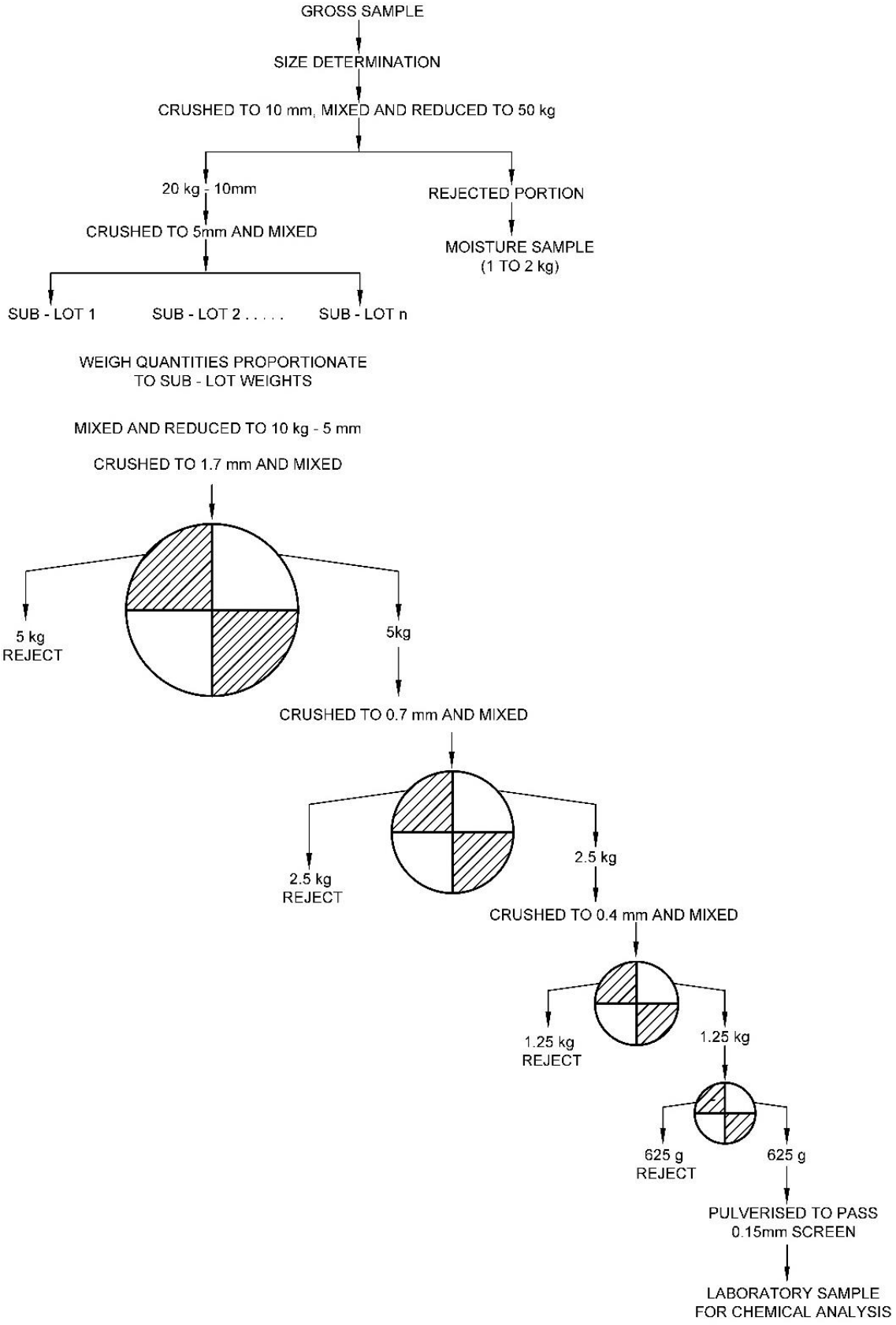

FIG.2 REDUCTION OF A GROSS SAMPLE

11.5.3 *Other Mechanical Dividers*

Mechanically operated dividers like rotary divider may be used provided their efficiency has been tested.

11.5.4 *Increment Reduction*

The crushed ore shall be mixed and spread on a smooth non- absorbent surface to form a uniform flat rectangle with the thickness specified in Table 3. The rectangle shall be divided into 20 equal parts, 5 lengthwise and 4 breadthwise. From each of the 20 parts so formed, equal quantities of ore shall be taken with a scoop, the capacity of which shall be as shown in Table 3. The 20 increments taken are combined to form the reduced sample.

Table 3 Increment Reduction

(*Clause* 11.5.4)

Sl No.	Size of Ore	Thickness of Layer	Quantity of Increment taken from Each Part
	mm	mm	g
(1)	(2)	(3)	(4)
i)	10	30 to 40	55
ii)	5	25 to 35	250
iii)	1.7	15 to 25	100
iv)	0.7	10 to 15	50
v)	0.4	5 to 10	25
vi)	0.15	5 to 10	10

11.6 Moisture Sample — from the rejected portion of the gross sample at 10 mm stage, a moisture sample of kg 1 to 2 kg shall be taken after proper mixing of the rejected sample. This sample shall be transferred immediately to a container like bottle or polythene jar with an air-tight moisture-proof cap. Separate moisture sample for each sub-lot shall be collected. These shall be sent immediately to the laboratory and the moisture test carried out without delay in order to avoid changes in moisture content.

11.7 Laboratory Sample

The laboratory sample after being reduced and crushed to pass through 150 micron IS Sieve, as given in Fig. 2, shall be muted and divided into 3 or more (if necessary) equal parts. These shall be preserved in clean and dry, well stoppered bottles and labelled with full particulars, such as source, supplier's name, purchaser's name, date and place of sampling, total quantity, name of steamer, if any, and any other relevant details.

12 NUMBER OF TESTS

12.1 Moisture Samples

All the moisture samples k presenting a lot shall be tested individually for moisture content. From the quantities represented by the individual sub-lots, the composite moisture for the entire lot shall be calculated as given in formula in **13.3.2** and reported.

12.2 Laboratory Samples

When the variation in quality of individual sub-lots is required or when required by the parties concerned, each gross sample shall be individually tested for important characteristics, namely, barium sulphate, silica and iron. When, however, only the average quality of the lot is required, the composite sample prepared as shown in Fig. 2, shall be tested for all the chemical characteristics required by the parties concerned.

13 REPORTING

13.1 Size Test

The percentages of different size groups for the entire lot shall be reported (*see* **10.6.2**) unless otherwise required by the parties concerned in which case the results for each sub-lot may be reported.

13.2 Moisture Test

The average moisture content for the entire lot shall be reported unless otherwise required by the parties concerned, in which case the results of each sub-lot shall be reported.

13.3 Chemical Analysis

13.3.1 When only the composite sample has been tested, only one test result will be available for each characteristic and that result shall be reported as the value of the characteristic for the lot.

13.3.2 When two or more laboratory samples have been tested individually for a lot, the individual results of each characteristic shall be reported to give an indication of the variation in quality. In addition be also calculated from the following formula:

$$\text{Average } (x) = \frac{(x_1 + w_1 + x_2 + w_2 + \cdots\cdots\cdots\cdots x_{n\times} w_n)}{W}$$

where

x_1, x_2,……..x_n are the individual results of n gross samples for the particular characteristic;

w_1, w_2,……w_n are the weights of individual sub-lots; and

W is the total weight of the lot (= w_1, w_2, …….w_n).

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Ores and Feedstock for Iron and Steel Industry Sectional Committee, MTD 13

Organization	*Representative(s)*
National Mineral Development Corporation Ltd, Hyderabad	SHRI RAJAN KUMAR **(*Chairperson*)**
Agni Steel Private Limited, Erode	SHRI A. RAJASEKARAN
Alex Stewart International (India) Private Limited, Visakhapatnam	SHRI DEBASISH PAL SHRI S. BALAJI (*Alternate*)
Arcelor Mittal and Nippon Steel India Ltd, Visakhapatnam	DR ATANU RANJAN OJHA SHRI CH. V. S. ND. HARIPRASAD (*Alternate*)
Bhabha Atomic Research Centre, Mumbai	DR SANJIB MAJUMDAR DR ABHISHEK MUKHERJEE (*Alternate*)
Centre for Engineering and Technology (SAIL/CET), Ranchi	SHRI BRAJESH KUMAR SHRI D. K. JAGANI (*Alternate*)
CSIR - Institute of Minerals & Materials Technology, Bhubaneswar	DR ASHOK SAHU DR S. P. DAS (*Alternate*)
CSIR - National Metallurgical Laboratory, Jamshedpur	DR MANOJ KUMAR MOHANTA
Federation of Indian Mining and Mineral Industries, New Delhi	SHRI B. K. BHATIA
Fomento Resources Private Limited, Panaji	SHRI MAHENDRA MANGUESH RAMANI SHRI ABHIJIT PEDNEKAR RAMANI (*Alternate*)
Geological Survey of India, Kolkata	DR UTPAL ROY CHOUDHURY
Indian Bureau of Mines, Nagpur	SHRI L. B. TOAL SHRI SANTOSH PANI (*Alternate*)
Indian Ferro Alloy Producers Association, Mumbai	SHRI TANMAYA KUMAR PATTNAIK SHRI SITA RAM (*Alternate*)
Jai Balaji Group, Kolkata	SHRI D. SAHOO
Jindal Stainless Ltd, Hissar	SHRI ASHISH GOYAL SHRI SUYASH TRIVEDI (*Alternate*)
JSW Steel Ltd, Bellary	SHRI P. C. MAHAPATRA SHRI C. R. PRAMOD KUMAR (*Alternate* I) SHRI N. SAI RAM KRISHNA (*Alternate* II)
KIOCL Limited, Bengaluru	SHRI M. A. SALAM SHRI P. PALANI (*Alternate*)
Manganese Ore (India) Ltd, Nagpur	SHRI RAJESH BHATTACHARYA SHRIMATI SNEHA TIWAR (*Alternate*)

Organization	*Representative(s)*
Mineral Exploration Corpn Ltd, Nagpur	SHRI P. RAVINDRAN SHRI SANTOSH KUMAR SATAPATHY (*Alternate*)
Mitra S.K. Pvt Ltd, Kolkata	SHRI SAJAL MITRA SHRI P. L. BOSE (*Alternate*)
M.N. Dastur & Co Ltd, Kolkata	SHRI AVIJIT PODDAR
National Institute of Secondary Steel Technology, Mandi, Gobindgarh	SHRI SHRI RAJIB KUMAR PAUL SHRI SANDEEP PAL SINGH (*Alternate*)
National Mineral Development Corporation Ltd, Hyderabad	SHRI VIBHUTI ROSHAN
Pellet Manufacturer's Association of India, New Delhi	SHRI DEEPAK BHATNAGAR
Rashtriya Ispat Nigam Limited, Visakhapatnam	SHRI T. GOUTHAM SHRI RANJAN MOHANTY (*Alternate*)
SAIL - RDCIS, Ranchi	SHRI V. DAYAL SHRI S. ACHARYA (*Alternate*)
Sponge Iron Manufacturers Association, New Delhi	SHRI D. KASHIVA
Tata Steel, Jamshedpur	DR A. K. MUKHERJEE
Tata Steel Long Products Limited, Jamshedpur	SHRI MANIKANTA NAIK SHRI GYANARANJAN POTHAL (*Alternate*)
BIS Directorate General	SHRI SANJIV MAINI, SCIENTIST 'F'/SENIOR DIRECTOR AND HEAD (METALLURGICAL ENGINEERING) [REPRESENTING DIRECTOR GENERAL (*Ex-officio*)]

Member Secretary
SHRI RAM SAI KUMAR GEDELA
SCIENTIST 'B'/ASSISTANT DIRECTOR
(METALLURGICAL ENGINEERING), BIS

This Page has been Intentionally left blank

(*Continued from second cover*)

The composition of the Committee responsible for formulation of this standard is given in Annex A.

In reporting the result of a test or analysis made in accordance with this standard, is to be rounded off, it shall be done in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be same as that of the specified value in this standard.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Head (Publication & Sales), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in

This Indian Standard has been developed from Doc No.: MTD 13 (22090).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
Central	: 601/A, Konnectus Tower -1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002	2323 7617
Eastern	: 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091	2367 0012 2320 9474
Northern	: Plot No. 4-A, Sector 27-B, Madhya Marg, Chandigarh 160019	265 9930
Southern	: C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113	2254 1442 2254 1216
Western	: Plot No. E-9, Road No.-8, MIDC, Andheri (East), Mumbai 400093	2821 8093

Branches : AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. CHANDIGARH. CHENNAI. COIMBATORE. DEHRADUN. DELHI. FARIDABAD. GHAZIABAD. GUWAHATI. HIMACHAL PRADESH. HUBLI. HYDERABAD. JAIPUR. JAMMU & KASHMIR. JAMSHEDPUR. KOCHI. KOLKATA. LUCKNOW. MADURAI. MUMBAI. NAGPUR. NOIDA. PANIPAT. PATNA. PUNE. RAIPUR. RAJKOT. SURAT. VISAKHAPATNAM.

Published by BIS, New Delhi